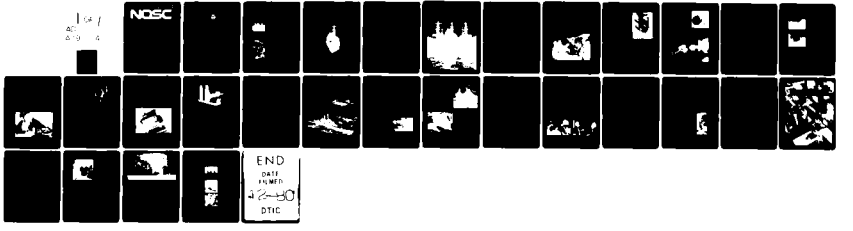
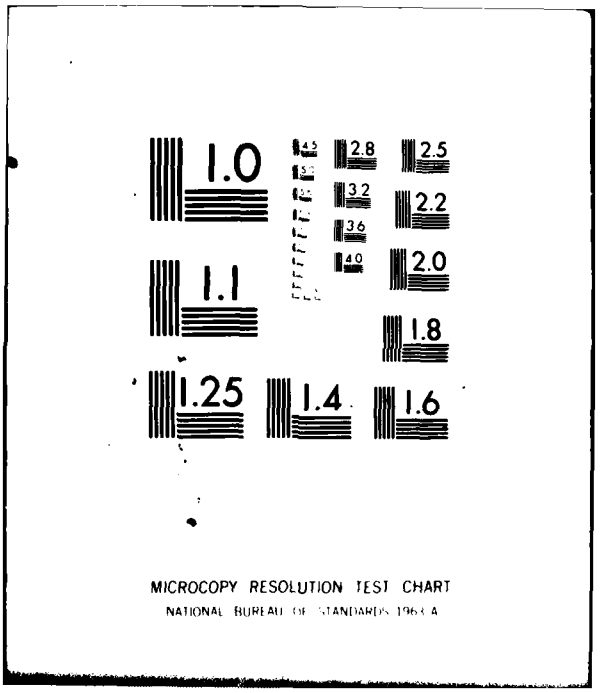
AD-A091 114 NAVAL OCEAN SYSTEMS CENTER SAN DIEGO CA F/G 15/5
FLEET READINESS OFFICE FY 78 ACTIVITY SUMMARY.(U)
MAR 79
UNCLASSIFIED NOSC/TD-214 NL




1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963 A

LEVEL II

NOSC

NOSC TD 214

AD A091114

(12) 30 (11) 1 Mar 79

(14) NOSC/TD-214

Technical Document 214

(6)

FLEET READINESS OFFICE FY 78 ACTIVITY SUMMARY.

(9) ~~1 March 1979~~ Summary Report, Oct 1977-Oct 1978.

Approved for public release; distribution unlimited

NAVAL OCEAN SYSTEMS CENTER
SAN DIEGO, CALIFORNIA 92152

NAVAL OCEAN SYSTEMS CENTER, SAN DIEGO, CA 92152

AN ACTIVITY OF THE NAVAL MATERIAL COMMAND

RR GAVAZZI, CAPT, USN
Commander

HL BLOOD
Technical Director

Foreword

This is the second annual summary of the activities of the Fleet Readiness Office (FRO). Like the first, it is selective rather than inclusive, compendious rather than detailed – that is, not all of FRO's projects are described, and those that are are presented only in summary form. Our purpose is to present an overview of FRO's range of activities on behalf of the Fleet in FY 78.

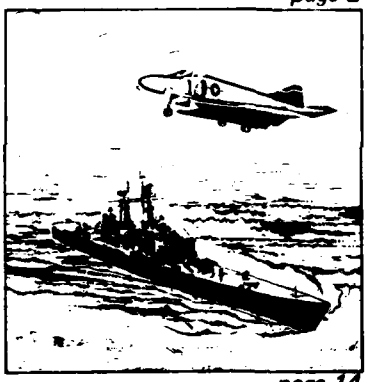
FRO's achievements, as reflected in the projects described in this summary, depend on the talents and dedication of personnel in FRO and throughout NOSC, and this seems an appropriate place to acknowledge their contributions and our indebtedness.

LCDR R. W. Cherry, Deputy Head
Fleet Readiness Office

M. M. Baldwin, Acting Head
Fleet Readiness Office

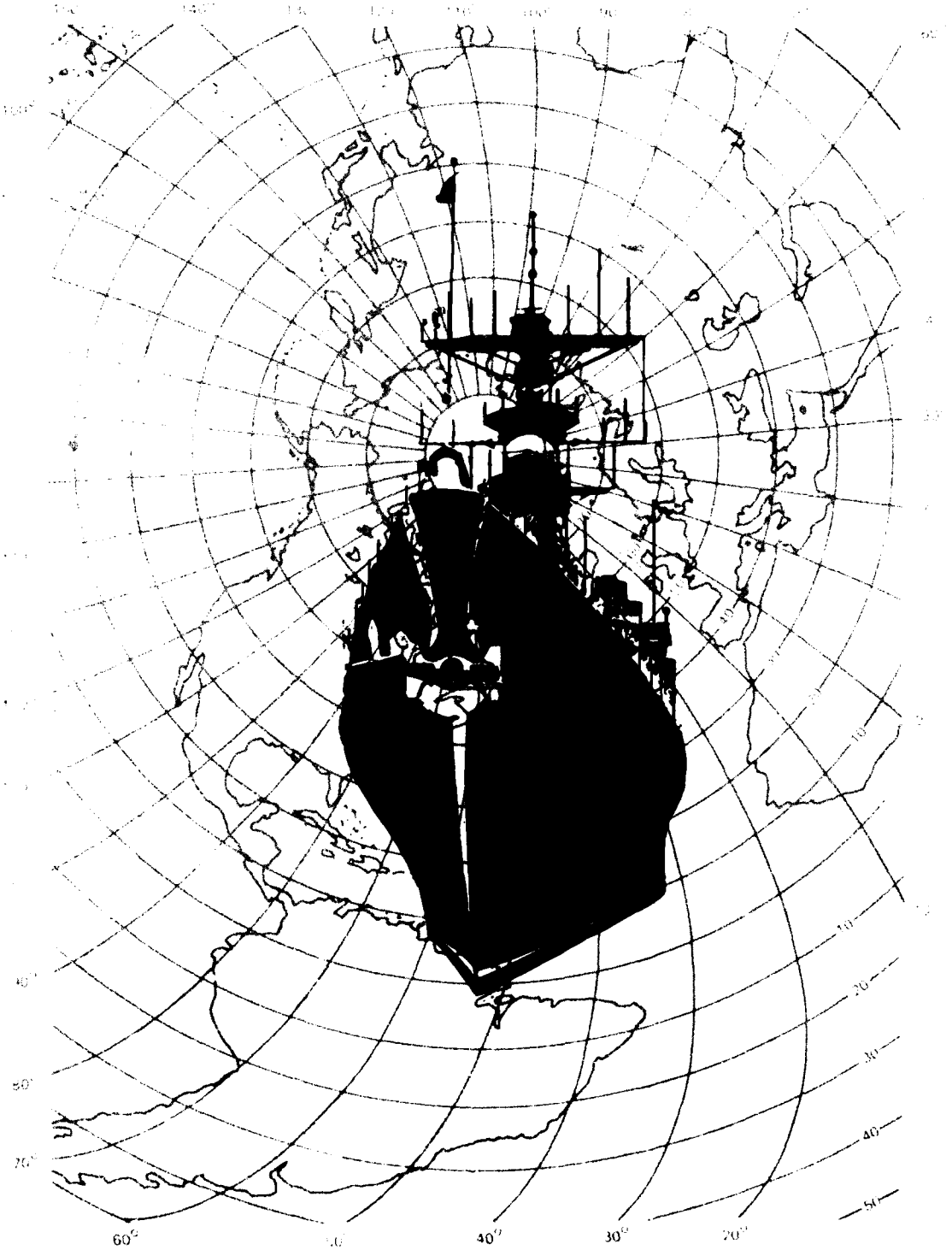
Contents

page 2



page 14

page 22


60°
40°
30°
20°
10
20
30
40
50

Introduction

The Fleet Readiness Office (FRO) exists to serve the needs of the Fleet in a direct and timely fashion. This means solving existing operational problems *now*. But it also means anticipating problems and needs that are likely to arise in the near future.

To attain these ends FRO maintains close and constant liaison with Navy and Marine Corps operational commands and with the technical community at NOSC. Through the interplay of continuous feedback, FRO is able to act as both a conduit and a catalyst—carrying information of Fleet operational problems to the technical community and at the same time stimulating the technical community to direct its efforts toward potential Fleet problems.

Specifically, in terms of the functional organization, FRO has Center responsibility for (a) technical management and administration of near-term and quick-reaction technical support for Fleet and Marine Corps operational commands; (b) evaluation and identification of Fleet operational problems through Fleet exercise liaison and participation; (c) technical direction, technical management, and technical support of operationally oriented problems and measurement range activities; (d) management of the Navy's Science Assistance Program and the Laboratory Fleet Support program; and (e) participation in Navy-wide high-level committees for naval warfare.

In carrying out these responsibilities, FRO utilizes the scientific and technical personnel and facilities of codes throughout NOSC, bringing to bear on Fleet problems the full strength and breadth of the Center's resources. FRO also directs its efforts toward making the Fleet aware of NOSC's capabilities, especially as they have relevance to Fleet concerns. Through this two-way information exchange, FRO is able to anticipate potential problem areas in the Fleet and to facilitate and expedite the desired solutions.

FRO discharges its mission primarily by establishing a number of programs of varying scope and technical complexity. Representative projects have been selected from these programs to document in this report NOSC's major technical achievements in support of the Fleet in FY 1978.

Quick-reaction fleet support programs

Navy science assistance program and laboratory fleet support program

General

The Navy Science Assistance Program (NSAP) has been established to help Navy and Marine Corps forces determine the feasibility of using various technologies to fulfill their operational requirements.

NSAP's objective is to provide quick-reaction response to the needs of the Fleet commanders. The assignments of NSAP science advisors and laboratory representatives are intended to assist the system commands in clarifying problems as well as in solving them. NSAP science advisors and other representatives help the operating commands improve their effectiveness by bringing technical expertise to bear on important operational problems. Laboratory technical personnel are thereby educated to the problems and operational environment faced by the Fleet. NSAP science advisors are assigned to major Fleet commands for 1 year, with a possible 1 year extension. The NSAP advisors and laboratory representatives identify and screen Fleet problems to ensure their command concurrence, and subsequently request assistance where appropriate.

NOSC provided NSAP science advisors to COMTHIRDFLT and CINCLANTFLT, and NSAP laboratory representatives to CTF 69, Marine Corps Development and Education Center, Marine Corps Tactical Systems Support Activity, and COMSUBLANT. The position of CINCLANTFLT NSAP science advisor is being filled by the head of FRO.

NSAP projects at NOSC for FY 78 were:

Task	*Title*
L-9-77	AN/SPN-43A Polarizer
Q-3-77	Palm Tree Exercise
SURFP-02-77	Automated Freq Allocation
SURFP-03-77	Ducting Predictor
SURFP-04-77	S/W Sonobuoy
SURFP-05-77	Boiler Tube Inspection
TH-5-77	Jammer
CON-5-78	NAVEUR C2
Q-2-78	Broadband VHF Antenna
S-4-78	NAVEUR ECLIPS
SEC-1-78	Flag Ship Config Study
SEV-4-78	PROCAL Radiosonde
SUBP-1-78	Alternate NAU
SURFP-05-78	Msg Entry Study
TH-1-78	Gann Medipac
TH-2-78	Airborne UHF Relay
TH-3-78	Secure Voice

Gann medi-pac and NOSC medical backpack

The Gann Medi-Pac Unit and the NOSC Medical Backpack are two recent developments that improve the present method of transporting medical equipment and supplies aboard ship. The Gann Medi-Pac Unit is a standard flight-deck vest life preserver that has been modified to carry medical supplies and is intended to replace the standard "unit one" military first-aid kit in certain shipboard situations. The NOSC Medical Backpack is a backpack frame that can be arranged to carry a variety of medical equipment and supplies to a shipboard injury where a unit one or Gann Unit is not adequate.

The Gann Medi-Pac was developed by HM3 Larry Gann, attached to VA-22, NAS, Lemoore, California. While deployed with VA-22 aboard the USS Coral Sea during 1977, Gann recognized an operational need for an improved method of carrying emergency medical trauma supplies while on the flight deck. The standard unit one medical kit was both cumbersome and nonfunctional.

After experimenting with several ideas, Gann decided that the most convenient and practical method of carrying the medical supplies was by the use of pockets sewn on a standard flight-deck vest life preserver, which he was required to wear during flight operations. The pockets were sewn so as not to interfere with the inflation of the life vest. Several individual pockets on the vest allowed the

Wearing the medi-pac he designed, Hospital Corpsman Third Class Larry Gann explains to naval hospital staff members at the Naval Air Station in Lemoore, Calif., what items are carried in the pockets sewn on the standard flight deck life preserver.

medical supplies to be contained separately, making them quickly and easily accessible while allowing maximum mobility for the corpsman.

The advantages of the unit are:

- The corpsman is able to carry more useful items, such as inflatable splints, and a greater variety of dressings.

- The Gann Medi-Pac Unit is less bulky, and the corpsman can move freely without becoming potentially entangled.

- The cost is nominal. The vest is merely a flight-deck life jacket modified with pockets constructed from stock materials.

- Safety is an important advantage in this item. The vest bladder inflates with ease, even with a full pack.

The Gann Medi-Pac also has applications in a civilian environment, useful wherever first-aid supplies and a life preserver are required, such as on offshore oil rigs and commercial ships.

The concept of the Gann unit was recommended for use by the senior medical officer on the USS Coral Sea. The Bureau of Medicine and Surgery and COMTHIRDFLT both endorsed the concept and recommended a Fleet test and evaluation. NSAP then funded NOSC to produce fourteen of the Gann Medi-Pacs for test and evaluation on several classes of ships, including carrier, ammunition, supply, oiler, escort, and submarine. The Medi-Pacs were recently placed on these ships for testing while deployed in WESTPAC. HM3 Gann participated in placing these units on the ships and in briefings to COMTHIRDFLT, CINCPACFLT/ COMNAVLOGPAC Medical Officer, and their respective staffs. An evaluation questionnaire from each of the ships will be reviewed by COMTHIRDFLT.

Corpsman wearing medi-pac during test and evaluation aboard the USS New Orleans demonstrates access through an 18-inch-diameter hatch.

Inspection of ship boiler tubes

The Navy has a requirement for nondestructive inspection of the full length of ship boiler tubes. This requirement includes both visual and ultrasonic inspection, with the ability to make a hard copy of the test data. Existing visual equipment limits inspection to only 3 feet or less at each end of the boiler tubes, which vary from 15 to 30 feet in length. At present, there is no equipment that enables one to visually inspect the center section or directly record results of the inspection.

The objective, therefore, is to construct a working model which would include a 15-foot optical fiberscope coupled to a color TV camera and a wide angle lens. The device would also incorporate an ultrasonic head and

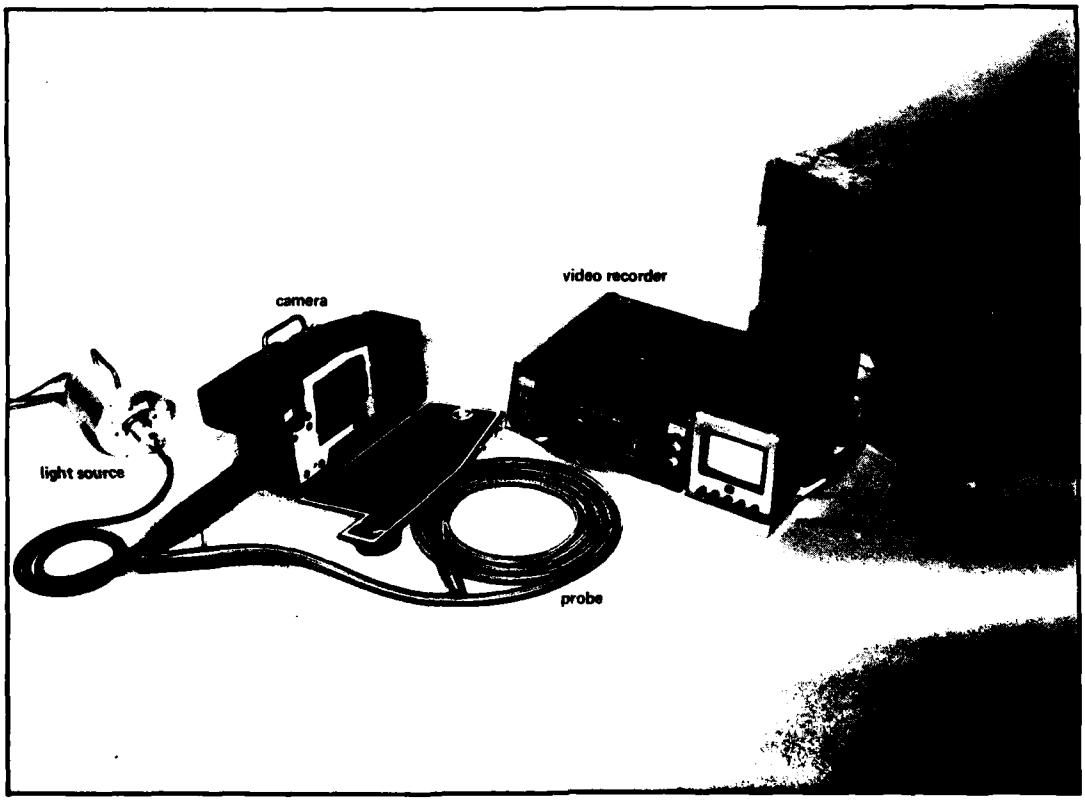
digital readout of the tube thickness. The goal is to build a device that can inspect optically and ultrasonically at the same time over the full length of a ship's boiler tubes.

NOSC procured the fiberscope from American Optical, and used the system on a desuperheater inlet line aboard the USS Jouett.

In less than an hour, the inspection device disclosed a hand-hole cover that was adrift in the 4-inch line. The ship's crew had been probing the steamline for a number of days trying to find the problem, without success. The boiler tube inspection group estimates a saving in X-rays alone of $2500 per full inspection.

The inspection system is now being put in cases in an attempt to achieve the most compact form possible.

above: *Video tape of hand-hole cover lodged against a backing ring between two welded sections of the desuperheater line of the USS Jouett.* below: *Fiber optic boiler tube inspection device.*



Ducting predictor

In the past 25 years, the understanding of the evaporation duct mechanism and the meteorological boundary layer theory necessary to properly describe the duct have undergone radical changes. Newer techniques and algorithms do exist to properly assess the evaporation duct and its effect on radar propagation, but have not yet been put in a form suitable for operational Fleet use.

NSAP requested NOSC to develop graphical or tabular techniques that could be used aboard surface ships to assess the effects of surface ducting on surface-target detection and to develop a document explaining surface duct effects and the techniques developed under this effort. NOSC utilized existing proven physical models and computer algorithms to produce easy-to-use graphical methods.

These methods were developed to assess the effects of surface ducting on the capability of existing Fleet radars to detect destroyer-size surface targets. Application of the developed methods to Harpoon targeting was stressed. Both surface-based ducts created by elevated refractive layers and the surface evaporation duct were considered. A technical document (NOSC TD 144) was prepared that explains the ducting mechanisms and their effects on surface-target detection and details the use of the graphical methods.

NOSC TD 144 was distributed to a limited number of commands for comments and evaluation prior to wider distribution in the operational Fleet. Third Fleet tasked eleven surface combatants to evaluate the document. The results of their evaluations showed NOSC TD 144 to be easy to understand and use and to be a good predictor of extended surface-target detection range. It is anticipated that NOSC TD 144 will be promulgated as a COMTHIRDFLT Tactical Memo in the near future.

VHF whip antenna

The Navy and Marine Corps operate single and multiple-channel VHF communication systems in the 30-76 MHz band. These systems are installed on ships of the Fleet and on fast patrol craft, and are used extensively in both portable and mobile field communications ashore. VHF communications are used by the Marine Corps during amphibious operations.

The Navy and Marine Corps have a requirement for a new low-cost, lightweight replacement VHF broadband antenna. The primary candidates to be replaced are the vehicular AS-1729 and the mast-mounted RC-292. The reason for the RC-292 replacement is to obviate the need to rerig the antenna every time a significant frequency change is made, and to reduce the weight of the antenna to facilitate erection. The reason for the vehicular AS-1729 antenna replacement is to obtain a low profile (the AS-1729 is a 10-foot whip) and to improve reliability by replacing an electromechanically tuned antenna with an untuned antenna.

Furthermore, in USMC field applications, such as on the LVTC-7 command tractor, the large number of closely spaced whip antennas seriously distrubs the omnidirectional radiation characteristics of any one of the whip antennas. With a suitable RF summing network, the replacement wideband antenna could be used with several transmitters simultaneously.

Several antennas under development are being considered as replacements for the AS-1729 and RC-292. These antennas are expected to cost $100 to $300 in production quantities.

The NOSC wideband VHF antenna is a 71-inch fiberglass whip with a 5.5-inch mounting base compatible with mounts now used for AS-1729 antennas.

Comparison of flexibility of AS-1729 (top) and NOSC VHF whip antennas.

Six prototype antennas were delivered to Camp Pendleton for operational field testing by NOSC personnel with the participation of Marine Corps personnel. The operational performance of the NOSC antenna equaled or exceeded that of the AS-1729 and RC-292.

These tests indicate that the NOSC-designed wideband VHF whip antenna can satisfy the replacement function requirements at a cost of $30 to $60 in production quantities.

PROCAL radiosonde

Upper-air meteorological soundings are generally made twice daily aboard each carrier utilizing a standard 403 MHz balloon-borne radiosonde. Encoded pressure, temperature, and relative humidity information is telemetered to a receiver and moving paper chart as the radiosonde ascends through the atmosphere. At present, the information on the chart is processed manually, using a variety of monograms, graphs, and special-purpose slide-rules to obtain altitude, temperature, humidity, dew point temperature, dew point depression, and other parameters, including the radio refraction index or refractivity. The entire process can take 3 to 4 hours, even with trained personnel properly following all the procedures. Much of the resulting information, especially refractivity, is often needed by operations personnel aboard the carrier significantly earlier than the present 3- to 4-hour delay allows.

COMSEVENTHFLT requested NOSC to develop and document procedures that allow radiosonde observations to be processed in a timely manner, with special emphasis on refractivity and refractive effects. The project includes development of a computer program for the Wang 2200 programmable calculator that will manually accept pressure, temperature, and humidity as determined by radiosonde and supporting surface meteorological measurements as inputs and calculate and display all resulting meteorological parameters, including refractivity. The program also displays a propagation conditions summary that is identical in form to that given by NOSC's Integrated Refractive Effects Prediction System and fully formatted WMO radiosonde code. The primary output is alphanumeric displays suitable for either line printer or cathode ray tube, as determined by the programmable calculator configuration.

Preliminary operational testing of the program onboard the USS Ranger was successful and demonstrated its utility and

time-saving capability. A second test of the program by operational teams from PACMET-DET has begun. The final program, along with the NOSC technical note describing the program operation and suggested operational techniques, will be distributed to units of the Third and Seventh Fleets. Concurrent with the distribution, the program will be converted for use on the Hewlett Packard 9830 and Tektronix 4051 PROCALs.

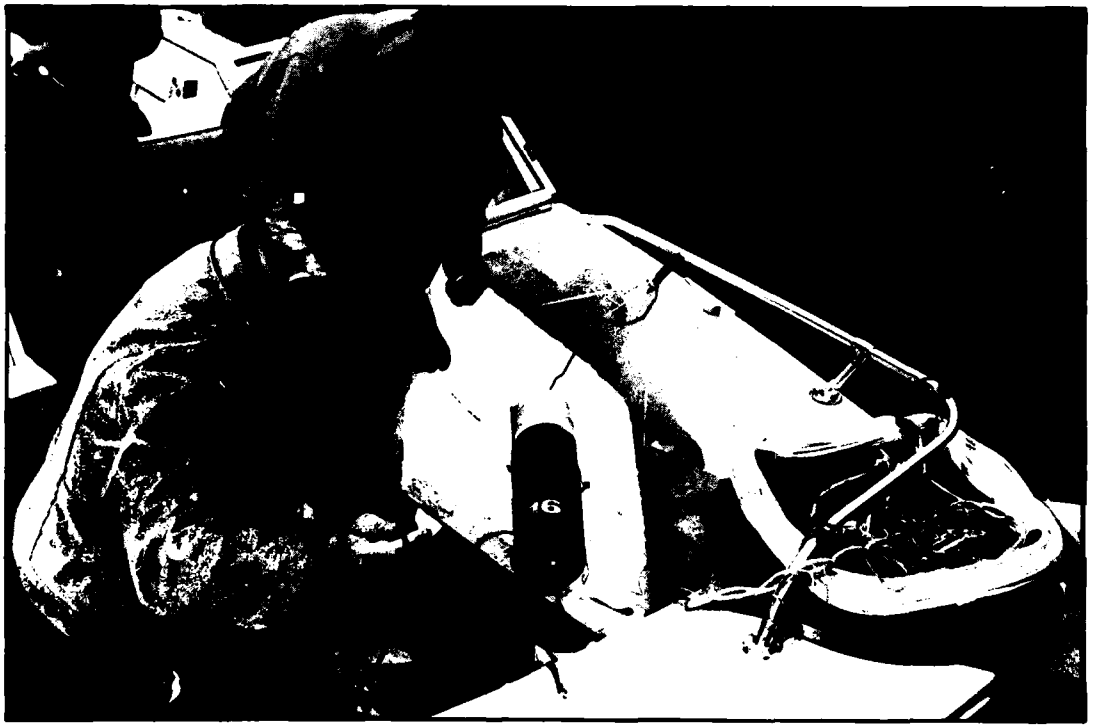
Shallow-water sonobuoys

The Inshore Underwater Warfare Group's anchored sonobuoys are VLF signal limited by low gain and cable strumming, and the buoys are large and tend to drag anchors or sink in high currents.

NOSC was tasked to improve the performance of the SSQ-58 sonobuoy so that low-frequency signals can be detected and processed; to develop and demonstrate a prototype anchored sonobuoy that will tolerate high currents without sinking or dragging its anchor; and to minimize or eliminate the effect of hydrophone cable strumming interference.

NOSC redesigned the SSQ-58 sonobuoy, and in several open ocean tests and a high-current mooring test at Port Angeles, Washington, the new sonobuoys exhibited good low-frequency signals.

Several more open ocean tests were made using a double-caged, double-armored cable. In addition, several experiments were made by running the signal cable directly from the hydrophones to signal processing equipment in the NOSC Oceanographic Tower off Mission Beach, California. In all of these tests, the redesigned SSQ-58 sonobuoy performed well at VLF.



Deploying the shallow-water sonobuoy in Puget Sound.

Tests were conducted to evaluate the utility of protecting sonobuoy hydrophones with flow shields. Two sonobuoys were anchored in 40 feet of water 1/2 mile southeast of Ballast Point during an ebb tide of 9 feet. Signals were recorded from the two sonobuoys at a receiving station set up at the degaussing site on Ballast Point. It was concluded that flows shields are not practical for hydrophones temporarily deployed on the bottom.

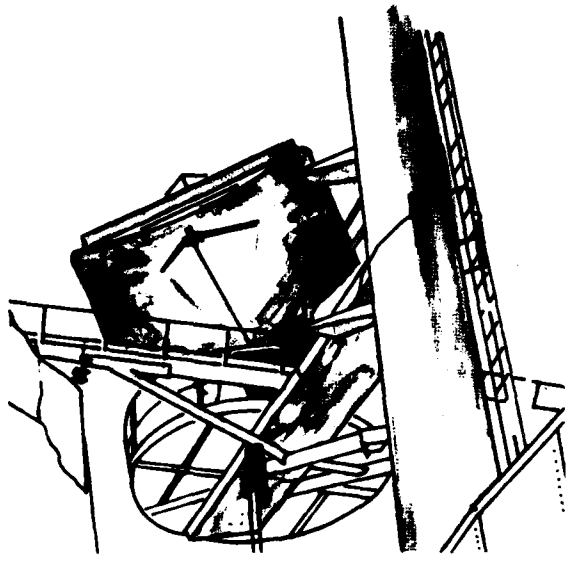
A cable tether was attached to a convenient exposed rock beyond the usual surf line off the tip of Point Loma. A week later, during a calm morning at high tide, a 2000-foot hydrophone cable was installed from an instrumented bunker on the end of Point Loma to a point west of the ship channel. The cable was attached at the 500-foot point to the previously installed cable-tether on the submerged rock beyond the surf line. About 100 pounds of tension was applied to the section between the tether and the top of the cliff near the bunker. Hydrophone signals were normal for five days following the installation and then the cable developed a short circuit.

Three of the new sonobuoy systems were delivered to 10WG-1 in September 1978.

AN/SPN-43A antenna modification

NOSC has undertaken a program to improve the ability of the AN/SPN-43A, a carrier surveillance radar, to control and identify aircraft in the presence of rain. This can be accomplished by adding a capability for remote selectable circular or horizontal polarization of the radiated signal.

The program is divided into two phases. Phase I, most of which was completed in FY 77, is an analysis and experimentation investigation of the properties of the radar antenna. Past work on the AN/SPN-43A



was reviewed and analyzed and measurements of the feed were made to determine effects of changes on the pattern slope and possible tradeoffs with performance. Proposals and current work being done in industry were reviewed and monitored. Phase II is the fabrication and measurement of a remotely controlled prototype. A breadboard or prototype polarizer was constructed and installed in an existing AN/SPN-43A antenna, and tests were conducted to demonstrate the improvement in the capability of the radar to detect and thereby control aircraft in the presence of rain.

Preliminary tests were conducted on various polarizers. A parallel plate polarizer was tested on the AN/SPN-43A antenna. This type of polarizer is a group of parallel plates placed in front of the antenna feed horn. Initial tests on the antenna indicated that some optimum setting and design of the vanes, along with refocusing on the feed, might result in a satisfactory polarization capability for the antenna. A model of the feed horn, with polarization vanes attached, was tested to determine if an optimum setting of the vanes in relation to the horn could be

found. Shaped vanes were also constructed and tested. The tests indicated that the phase across the horn would vary when the polarizer was switched from horizontal to circular polarization. The phase variation resulted in distortion of the antenna pattern. No adjustment could be found to alleviate the problem. The parallel plate polarizing grid placed close to the horn was determined to be an unworkable solution to the polarization problem.

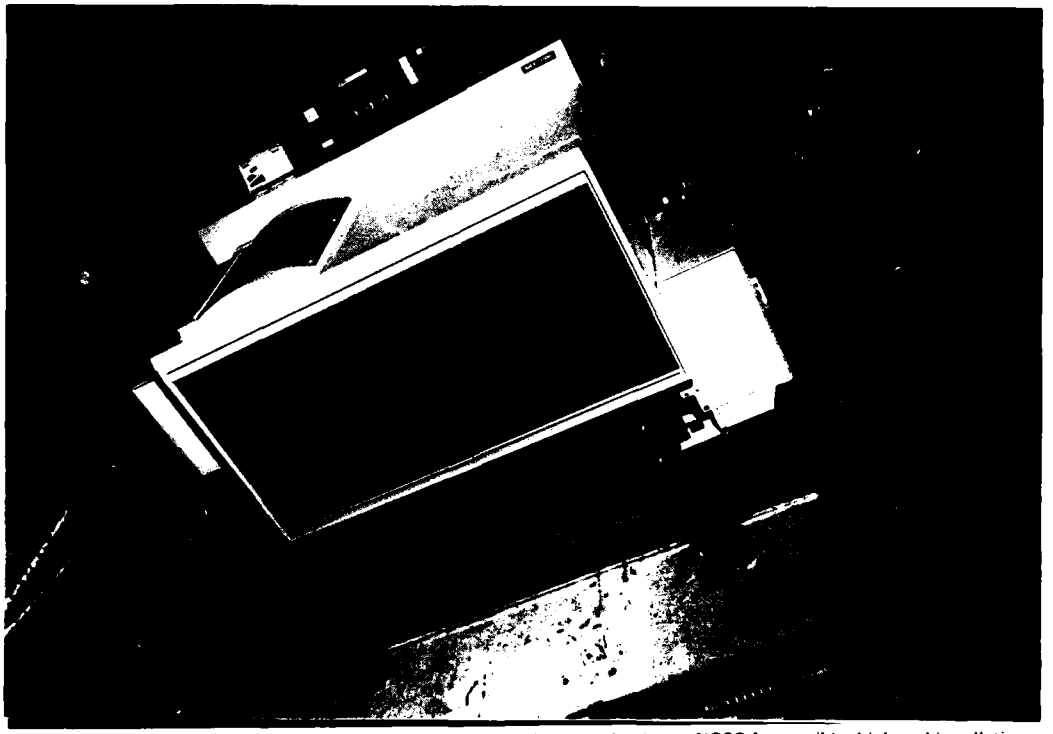
A more complex polarization grid structure was designed. This grid structure is similar in principle to the parallel plate polarizer. It is physically larger, will be placed a greater distance in front of the horn, and is configured to be less restrictive to the normal flow of energy from the horn. A model of this polarizer will be constructed and tested in FY 79.

Message reproduction and distribution

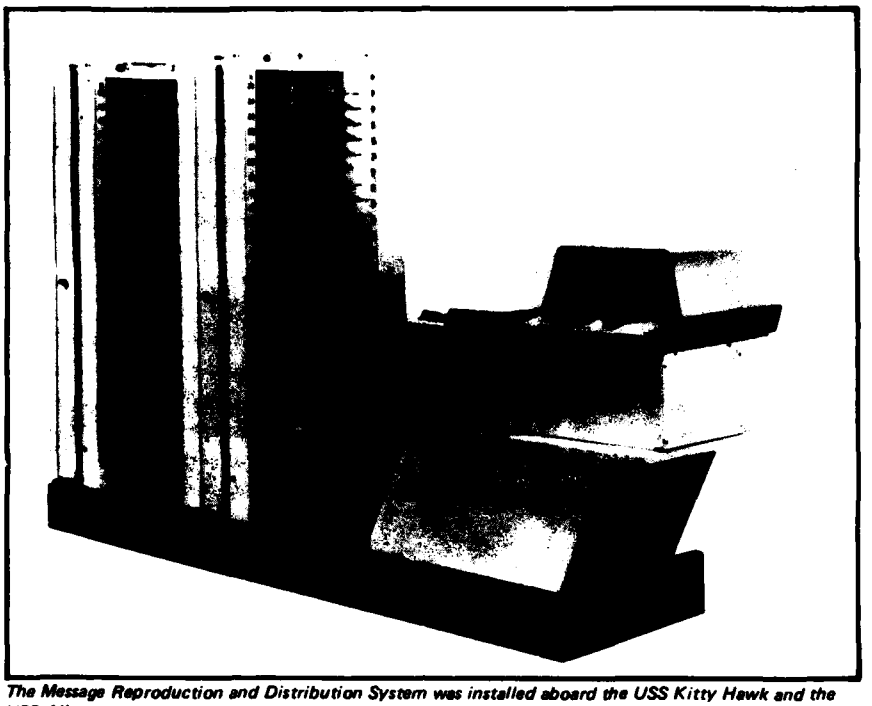
During the recent past NSAP has developed two systems for reproducing, sorting, stitching, and slotting naval messages aboard the USS Little Rock and the USS Kitty Hawk. These two systems were composed of off-the-shelf hardware and are unique.

NAVELEX funded FRO to develop an operational specification describing the functional and performance characteristics of a semiautomated message reproduction and distribution system based on the two systems installed on the two flagships.

NAVELEX also released a major procurement buy for three systems, with an option to buy 72 additional systems. NOSC is to provide the radio frequency interference,



Typical 35-degree tilt test for commercial reproduction devices during evaluation at NOSC for possible shipboard installation.



The Message Reproduction and Distribution System was installed aboard the USS Kitty Hawk and the USS Albany.

electromagnetic interference, and environmental test chambers for the reliability testing of the first preproduction system. OPEVAL was conducted on the USS Kitty Hawk. The second preproduction system was installed on the USS Albany. Environmental and electromagnetic interference testing is being conducted by NOSC on six copiers.

Air search — early warning radar improvements

Fleet operators on exercises have been reporting for several years that there are operating deficiencies in the lower frequency (VHF/UHF) radars. These problems are mainly centered on long-range detection, tracking, and target position data handover to weapon control radars.

NAVMAT requested that a study be done to investigate these reported problems in four specific radars: the AN/SPS-29, the AN/SPS-37, the AN/SPS-40, and the AN/SPS-43.

The purpose of this study was to isolate the problems and formulate some potential solutions. Specifically, the study was to investigate undetected targets, unreliable target acquisition, data handover to weapon control, high false-alarm rates, saturation of target tracking capability, and the short range of small-target detection.

The results of the study were given in an unreleased report prepared by NOSC. The report concludes that the problems are generally a result of inherent fundamental limitations in the physics of low-frequency antennas and wave propagation phenomena. Although some improvements can be made, due to better techniques and improved technologies now available, they do not represent simple fixes that can be easily or economically incorporated in the existing low-frequency radars. The report also points out that systems such as the AEGIS, AN/SPY-1, SSURADS, AN/SPS-XX, AN/SPS-58, and the AN/SPS-49 are all coming on well and will substantially improve the situation by 1982.

The results of this effort were briefed to COMTHIRDFLT, CINCPACFLT, and DNL during FY 78.

Upgrade of SUBLANT OPCON center

The current submarine OPCON centers have been in existence for a number of years. Understandably they have not been fully incorporated into today's automated environment, and the command support they provide to the submarine operational commander must therefore be continously reevaluated in light of the new technology.

An upgrade of these centers is now required in the areas of information displays, message formatting, processing and distribution, electrical interface with other communication and analysis centers, and direct command support to the OPCON centers operating personnel.

The capability required exists in today's technology, and can be procured in a relatively short time for a modest cost. Commensurate upgrade of the afloat C^2 facilities must be considered in conjunction with a NAVCOSSACT development of nonfunctional software for use on the World-Wide Military Command and Control Systems and the ASW Command Control and Communication System.

The objectives are (1) to develop a set of functional specifications which can be used to support the procurement of hardware for the upgrade of the SUBLANT OPCON Center; (2) to assist in determining the basic requirements for an implementation plan for SUBLANT to request sponsorship of the developed program; and (3) to develop a representative pilot program to demonstrate and test the upgrade concept.

The program was officially completed in FY 78 with a series of presentations and two documents. The recipients were the sponsors, SUBLANT personnel, and PME-108.

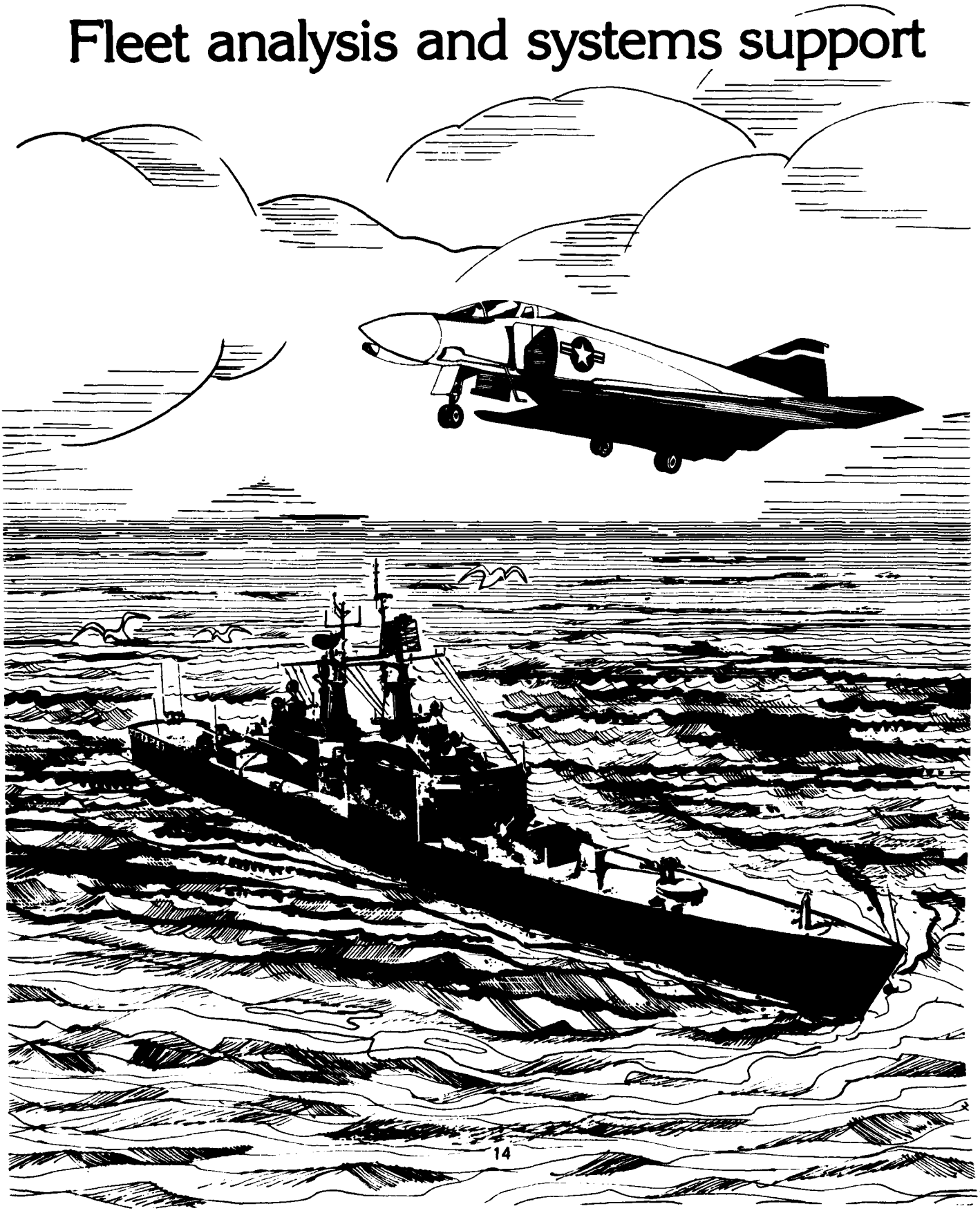
Noise augmentation

NOSC was asked to determine the feasibility of augmenting ship radiated noise by the internal forced vibration of submarine hulls, and to assess alternative methods of noise augmentation. This task was divided into two phases: Phase I entails conducting analytical and engineering evaluations of past theoretical and experimental investigations that have been judged feasible and practical for submarine applications.

The Phase I deliverable, which is in preparation, is a technical document assessing the capabilities of alternative methods of noise augmentation to meet Fleet objectives. A major objective of this task has been realized by the completion of "An Analysis of the Effects of Alternate Noise Augmentation Units on the Fatigue Life of 637-Class Submarines (U)." This analysis has given firm assurance that the technique can be applied without concern about overstressing hull structures. The final Phase I report is in preparation.

Phase II entails conducting laboratory and shipboard experimental investigations designed to supplement the finding in Phase I and to confirm performance characteristics of the system nominated for Fleet application. The Phase II deliverable will be a document containing test results, conclusions, and recommendations related to Fleet applications of alternative methods for noise augmentation.

Fleet analysis and systems support



Fleet analysis, exercise reconstruction, and support

Fleet analysis and reconstruction of exercises

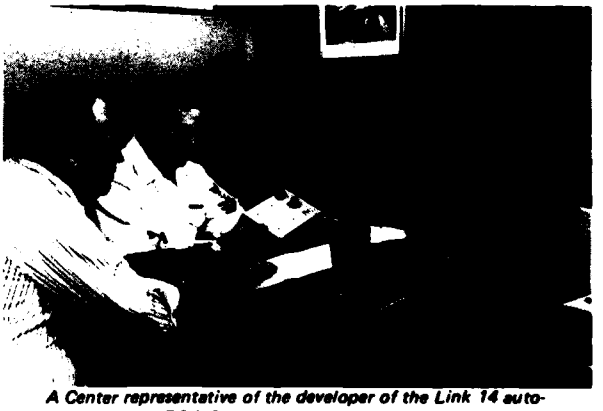
The Fleet Analysis and Reconstruction of Exercises (FAREX) program at this center is funded from several sources whose common interests are the analysis of weapon systems, the determination of Fleet requirements, and the investigation of automated support systems.

Over the years the FAREX program has developed a comprehensive set of data collection procedures, analysis techniques, and automated support programs. These capabilities were used this year in support of the analysis phase of the FAREX program. Specific analyses conducted were in the areas of ocean surveillance, information flow in the combat information center (the tactical action officer saturation problem), over-the-horizon targeting, and weapon system performance effectiveness.

In support of the above analysis it was necessary to develop tools to automate the analysis process. This was done in conjunction with the Naval Weapon Center (NWC), China Lake, in the development of two configurations of war games. The first was developed to use the computer assists of the Tactical Development Electronic Warfare (TACDEW) organization and dealt primarily with the Naval Tactical Data System (NTDS) and its components. The second effort was the development of a stand-alone capability using an HP 1000 mini-computer and appropriate displays. This effort was devoted to the gaming of the basic command decision processes and the evaluation of the system effectiveness.

A series of exercise and game reconstructions were conducted. These were done in TACDEW and the Applied Systems Development and Evaluation Center and used real Fleet inputs. The reconstructions were done in conjunction with NWC, China Lake, and the results are being used in the redefinition of the specifications for the stand-alone war game system.

The requirements for the above activities confirmed a need for the development of a number of different input-output devices and methods, use of higher speed display equipment, conversion equipment, and procedures to convert codes from one form to another. This development included the BAUDOT to ASCII buffers for the TEK 4051, the "Hurst box" and Link 14 autophasers for the NTDS computers, the NERF box for general interface configurations, and a series of null modems required to provide connectivity commonality. These developments have been included in the programmable calculator Transfer Interoperability System (TIOS).



A Center representative of the developer of the Link 14 autophaser and an FRO Fleet liaison representative discuss a report from the USS Yardly on use of the device in the Mediterranean.

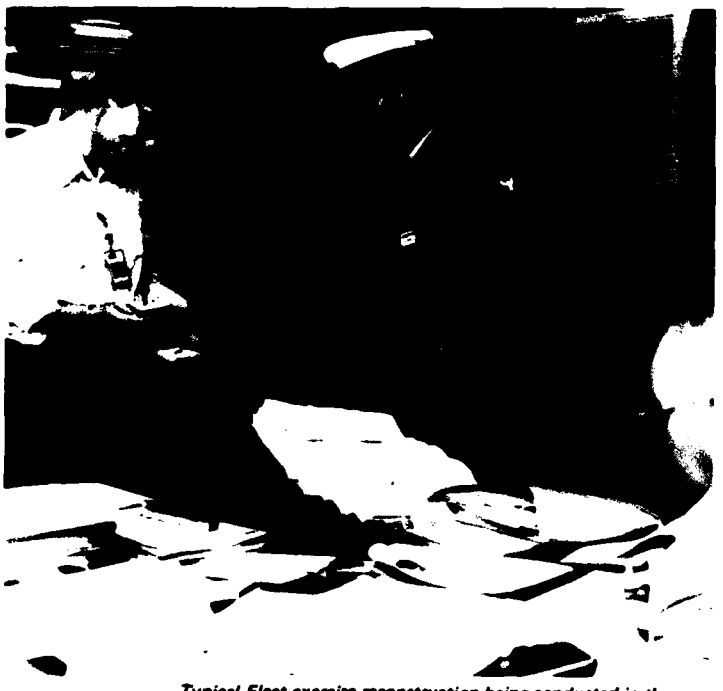
Participation in navy and marine exercises

FLEETEX 2-77 was a major exercise conducted by the Third Fleet in September 1977. FRO supported COMTHIRDFLT in October and November by conducting a reconstruction for all the participants. FRO also undertook a detailed analysis of the AN/SQR-15 Towed Acoustic Surveillance (TASS) performance. This analysis was published as a COMTHIRDFLT report.

In November 1977 FRO personnel assisted COMNAVSURFPAC in the preexercise training of TACD&E exercise TACEX 1-78. An FRO analyst acted as a SURFPAC observer on the TASS ship USS Bronstein, assisted with the reconstruction, and conducted an analysis of AN/SQR-15 performance.

FRO personnel acted as the data collection point in FLEETEX 2-78, sent the data on to the Third Fleet, and performed some preliminary track reconstructions.

FRO analyst and ship's officer observe a replenishment at sea during a break in ASW exercises during READIEX 3-78 aboard the USS Kinkaid.



Typical Fleet exercise reconstruction being conducted in the FRO reconstruction work area.

COMNAVSURFPAC sponsored ASW evaluation exercises during Phase III of READIEX 3-78, which took place in June 1978 on a transit between San Diego and ports in the Pacific Northwest. FRO personnel assisted with the evaluation plan, developed the data-collection plan, provided an observer aboard the USS Kinkaid, and conducted part of the reconstruction, analysis, and report writing.

In late April 1978 an FRO analyst participated in an analysis of the use and accuracy of the Interarray Processor. The processor is used by Navy enlisted personnel, and the purpose of the analysis, in part, was to determine whether they could handle the processor with a minimal amount of training or whether the processor should be modified to better suit their needs. The analysis entailed traveling to Commander Ocean Systems Pacific in Hawaii to collect the data. A similar analysis was undertaken in mid-August.

FRO prepared an operating-guidelines document for AN/SQQ-23-equipped ships that have been provided with an AN/BQR-20A spectrum analyzer. Included in this project were several at-sea evaluation tests.

FRO prepared two informal reports for COMNAVSURFPAC as suggested tactical quidance. The areas of interest include long-range ASW active-passive decision making and over-the-horizon acoustic targeting.

An FRO analyst spent FY 78 working at COMTHIRDFLT as the lead analyst on TACD&E project Task Force Operations Without A Carrier Available. In this capacity he participated in several exercises, coordinating the collection of data for purposes of over-the-horizon targeting and surface warfare analyses. In addition he was responsible for coordinating the surface warfare analysis for RIMPAC 78.

Third fleet analytical support

NOSC has been providing direct analytical support to COMTHIRDFLT since 1969. This support has included working in the areas of exercise reconstruction and analysis.

The objective is to gain an in-depth understanding of Fleet ASW, surveillance, and over-the-horizon targeting, and to assist in the development of new tactical doctrine for such operations. This program provides an essential means of information feedback to the Center's technical departments, thus enabling direct and timely response to current Fleet readiness deficiencies and to new system development possibilities in operations against the cruise missile threat.

AN FRO analyst worked as a member of the COMTHIRDFLT Analysis Team and provided on-site analytical support, including work on command and control exercise support; and assisted with surveillance analyses.

Tactical development and evaluation

General

FRO supported COMNAVSURFPAC in the development of ship charts that describe US and Soviet surface ship acoustic signatures. The descriptions were published in two separate documents and were issued as COMNAVSURFPAC instructions.

SHAREM

SHAREM is a series of exercises designed to collect high-quality exercise data to evaluate ASW operations. NOSC, in conjunction with NUSC, supported the Surface Warfare Development Group in SHAREM 26. This exercise was conducted in shallow waters located south of the Korean straits.

All exercise objectives were met, and significant acoustic data were collected which will be useful in planning future ASW operations.

Naval war gaming support

At the request of NWC, FRO supplied the China Lake facility with a minicomputer-based war gaming system. The system uses a modified set of FAREX computer programs and routines to implement the war game setup. FRO will provide NWC with continuing reconstruction and analysis of war games on a case-by-case basis.

Programmable calculator fleet support program

For several years now the Navy has used calculators to provide dedicated automated data processing to various levels of command. Examples of such usage are the Wang 2200 system in both the strike operations office and the war room on the USS Kitty Hawk (Outlaw Hawk); the Calculator Link Information Processing System (CLIPS) for monitoring the Link 14 broadcast; the mini-reconstruction on the HP 9830 for on-board reconstruction of small ASW exercises; and the joint munition effectiveness programs produced by NWC, China Lake, which uses the Wang 2200 system for weaponeering and strike planning functions.

NOSC, as lead laboratory for the Programmable Calculator (PROCAL) Fleet support program, fosters communication with Fleet activities through a series of PROCAL workshops and on-site visits. During FY 78, Workshops 5 and 6 dealt with technical information exchange and security requirements.

A PROCAL Fleet support center provides various system configurations, program development facilities, and program development assistance in order to provide hands-on experience and disseminate knowledge of Fleet requirements. Programming support is supplied for Fleet-owned calculator systems. The PROCAL Fleet support center develops and provides guidance on documentation standards and quality control, maintains a library of calculator programs, and provides systems for on-board Fleet application, test, and evaluation. Currently the PROCAL Fleet support center is involved with systems at over a dozen commands.

In FY 78, the PROCAL support program concluded its work in supporting the technical evaluation of programmable calculators proposed for procurement by CNO. This effort led to the introduction into the Fleet of 100 programmable calculator systems for use on submarines as nondedicated automated tactical decision support to the afloat commands.

NOSC is now using its full Extended Calculator Link Information Processing System (ECLIPS) capability in support of CINCPACFLT in the acquisition, test, integration, and installation of three ECLIPS in the Pacific. These systems will be placed on the USS Blue Ridge, USS Midway, and USS Ranger.

PROCAL program development team and a military user examine application programs designed to satisfy Fleet command support requirements. Support concepts and programming techniques are continuously reviewed in the development of PROCAL application programs.

PROCAL programs can be used to solve Fleet Area Surveillance Facility (FASFAC) scheduling problems in the SOCAL operating area.

FRO continued the work that was started at the request of COMSUBPAC to utilize TIOS to translate and transfer a number of programs written for the WANG 2200 to the TEK 4051. Development on TIOS continued during FY 78 and was extended to include other systems, such as the HP 9830/31/35/45 systems, the TRS 80, and a number of peripherals.

Chapman number program

The present Chapman Number Program represents a revitalization of a vibration analysis program initiated by COMCRUDESPAC in 1971 with the Destroyer Silencing Program. This was the first major step in establishing the Chapman Number system as a meaningful advance in Force maintenance procedures. Because of lack of funding support for a technical coordinating agency, this program became inactive. In 1976 CINCPACFLT, recognizing the benefits of such a program and the need for a technical support agency, reactivated the program for the FF-1052-class ships in the Pacific.

The objectives of the Chapman Number Program are to:

- Supply indoctrination and familiarization to commands on the theory, application, problems, and benefits of vibration monitoring.
- Monitor all ships' applied vibration data to ensure program growth and development.
- Act as technical liaison between concerned commands and COMNAVSURFPAC in areas of surface ship machinery vibration.
- Assist all concerned commands in their respective areas of responsibility in surface ship machinery vibration.
- Establish technical assist teams for scheduled ship visits to ensure proper installation of Chapman discs, to conduct machinery vibration monitoring team training, and to establish reliable baseline data.
- Provide system for monitoring each ship on its ability to apply machinery vibration analysis in the execution of a planned maintenance system.

As of FY 78, all of these objectives have been met. The project is now an ongoing program of COMNAVSURFPAC, with the Center consulted on technical problems on a case-by-case basis. NOSC published Technical Note 135, "Training Plan: Machinery Vibration Monitoring and Measurement Program using the Chapman Numbering System for FF-1052-Class Ships (Mobile Training Team)," by M. C. Turpen, ENS, USN, and Technical Note 274, "Procedures for Acquiring Chapman Number Baselines for Machinery Vibration Monitoring," by M. C. Turpen, ENS, USN, September 1977.

Surface ship machinery vibration monitoring

The ability of Navy ships to carry out their missions requires that all major and auxiliary machinery of the engineering system be maintained at their highest degree of readiness. It is also necessary that during operating periods all machines should perform efficiently according to design specifications.

Toward this end, NOSC was authorized to act as COMNAVSURFPAC Technical Support Agent in the field of surface ship

machinery vibration monitoring. In this role the Center has been able to assist the Pacific Fleet directly in rejuvenating its machinery vibration monitoring program aboard FF-1052-class ships. The program is almost fully implemented and its use has resulted in frequent successful detections of impending machinery failures and in the saving of many valuable man-hours in routine inspection and repairs.

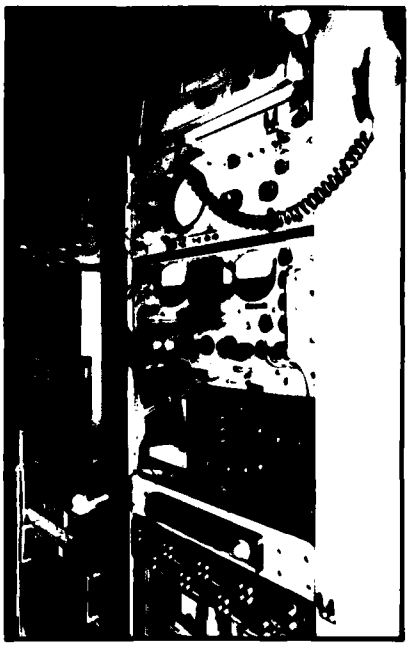
In the Chapman Number Program, NOSC is concerned with soft-mounted machinery on FF-1052-class ships; in this program NOSC gives particular attention to hard-mounted machinery on FF-1052-class ships. Specifically, NOSC will:

- Consult on technical procedures with the COMNAVSURFPAC-designated program managing code, Fleet units, supporting Navy activities, and contractors.
- Supply technical consultation on vibration measuring point disc design, locations, attachment procedures, and protection.
- Supply technical consultation and participate in the development of technical guidance for indoctrination and training in support of the COMNAVSURFPAC program's pilot phase of a hard-mounted machinery vibration monitoring program.
- Prepare and publish technical documents in support of the pilot phase.
- Supply a NOSC engineer to conduct program indoctrination (on three ships) for the pilot phase.
- Participate in pilot phase evaluation by providing consultation in review of pilot ship performance data and development of lessons learned.

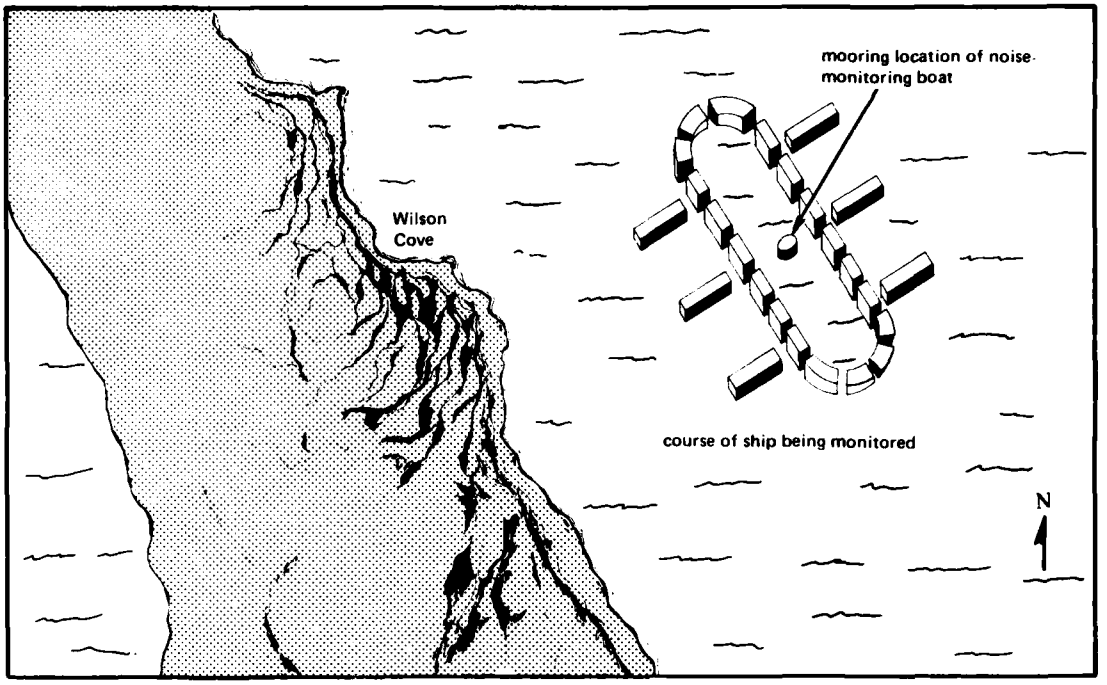
In addition to work items identified in this task, NOSC will provide other technical and administrative support as may be required and tasked by COMNAVSURFPAC in the field of ship machinery vibration and maintenance.

Surface ship radiated noise measurement program

In 1977 FRO was tasked by COMNAVSURFPAC to develop and demonstrate the feasibility of a program to determine acoustic characteristics of surface vessels. Such a program had to satisfy requirements of relatively short time ship availability for acoustic ranging and the determination of each ship's radiated acoustic noise as a function of ship speed. Such knowledge serves as baseline information for noise reduction and provides the tactician with additional capability for ship utilization.



Inside of mobile instrumentation hut used in the Surface Ship Radiated Noise Measurement program.



Location off San Clemente Island of site for Surface Ship Radiated Noise Measurement program.

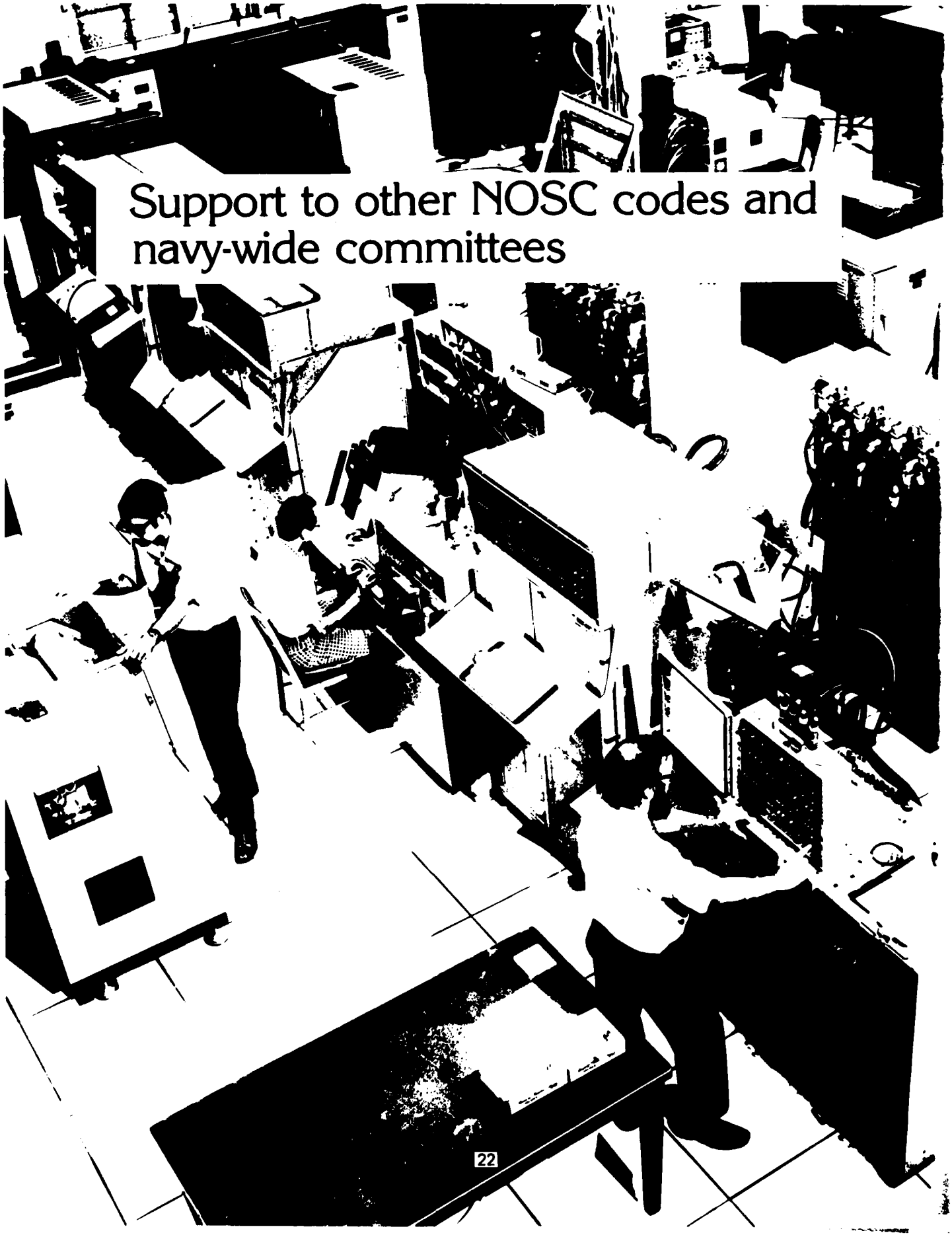
A small acoustic range for making these measurements of acoustic radiation was established off Wilson Cove at San Clemente Island. It consisted of a noise-monitoring boat, equipped with a mobile instrument hut, moored to a deep water buoy. Instrumentation in the hut receives, processes, displays, and records noise signals produced by the ship being ranged. A NOSC team on board the ship determines propeller cavitation information and then directs a series of controlled speed runs past the moored sound boat. The total time required to accomplish the acoustic ranging is about seven hours and is primarily dependent on the size and type of ship.

The program was laid out to include a three-phase approach: (1) demonstration of feasibility, (2) continued acoustic ranging of scheduled ships while designing a system and procedures for transition of the program to permanent conduct by FORACS I, and (3) program turnover to FORACS I.

Phase 1 has been successfully accomplished, and in FY 78 the program is well into Phase 2. A permanent bottom-tethered hydrophone system located in the same area as the present buoy with hard-line link to shore instrumentation has been designed and is scheduled for implacement in January 1979. In Phase 2, 18 ships have been ranged at the San Clemente Island site, and reports have been distributed.

The procedures for conducting the testing and for recording, reducing, analyzing, and interpreting the data have been well developed. Reporting formats and distribution have also been established. Thus the program turnover expected in FY 80 will have been well developed for routine scheduled acoustic ranging.

Support to other NOSC codes and navy-wide committees



Hull-to-emitter correlation

FRO provides technical management to the Hull-to-Emitter Correlation (HULTEC) program. The objective of the HULTEC program is to determine the acoustic radiation characteristics of surface ships and the vulnerability of the radiations to detection, classification, and localization.

In FY 78 data were assembled on intentional and unintentional noises, acoustic threat sensors, and transmission loss models. The primary emphasis is on the development of software for an acoustic detection module to run on the PDP 11 computer.

Underway replenishment ranging

NOSC designed and developed a short-range infrared distance measuring and communications equipment (DMCE) system as an aid in underway ship replenishment operations.

The current method of determining ship separation during alongside underway replenishment is somewhat deficient in accuracy, reliability, and efficiency.

While underway replenishment operations are being conducted, sailors maintain a taut line between the ships. Distance markers are placed on the line at appropriate intervals. As the ships move closer together or farther apart, the Conning Officer observes the motion and color of the flags as they pass through the sailors' hands. At night, lights are attached to the flag locations.

With this method, personnel are exposed on deck to possibly dangerous conditions during critical ship operations. In rough seas, passing and securing the line may be time consuming. Moreover, in case of emergency breakaway, time and personnel must be allocated to release the line or, as is most probable, to cut it, which necessitates the additional expense of obtaining a replacement.

By contrast, a covert transmitter-receiver can continually monitor ship separation, even before any lines are passed between the ships, and without any manpower being involved.

The DMCE system developed by NOSC in FY 77 had a range capability of 100 yards, but was neither as accurate nor as reliable as was desired. In FY 78 a systems analysis led to the:

- Redesign of the phase detector to eliminate phase ambiguity.
- Redesign of the receiver to minimize phase shifts and drifts.
- Separation of ranging and communication transmitters to remove interaction.
- Redesign of receiver preamps for improved sensitivity and selectivity.
- Repackaging for ease of maintenance and repair.

To date, the communications system has been completely checked and tested, yielding usable communications at 450 feet. Final adjustments and modifications to the ranging circuitry were being implemented as FY 78 came to a close. At-sea testing of the NOSC DMCE system is planned for FY 79.

New ASW TACNUC weapon systems

Because of the increasing capabilities of threat submarines, a continuing examination of Navy ASW weapon systems is essential, as is an evaluation of present tactical nuclear ASW systems for air, surface, and subsurface delivery. In February 1978, the Chief of Naval Operations ordered a Phase I nuclear ASW weapon study, the objective of which is to point out deficiencies in present ASW weapon systems and offer alternatives.

George Meyer, FRO, and Ray Tillery, NWEF, discuss the relationship of the size of submarine probability area to weapon requirements.

The technical direction of this NAVSEA-funded program was given to the Naval Weapons Evaluation Facility (NWEF) at Albuquerque, New Mexico. Participation in the steering committee and major contributions are being provided by NOSC, NUSC, NWC, and NSWC. Department of Energy laboratories are providing the nuclear weapon expertise.

A major milestone occurs approximately one year from the initiation of the program. At that time the requirement for a new TACNUC weapon system will be decided. The decision, by OPNAV, will determine the direction of the study.

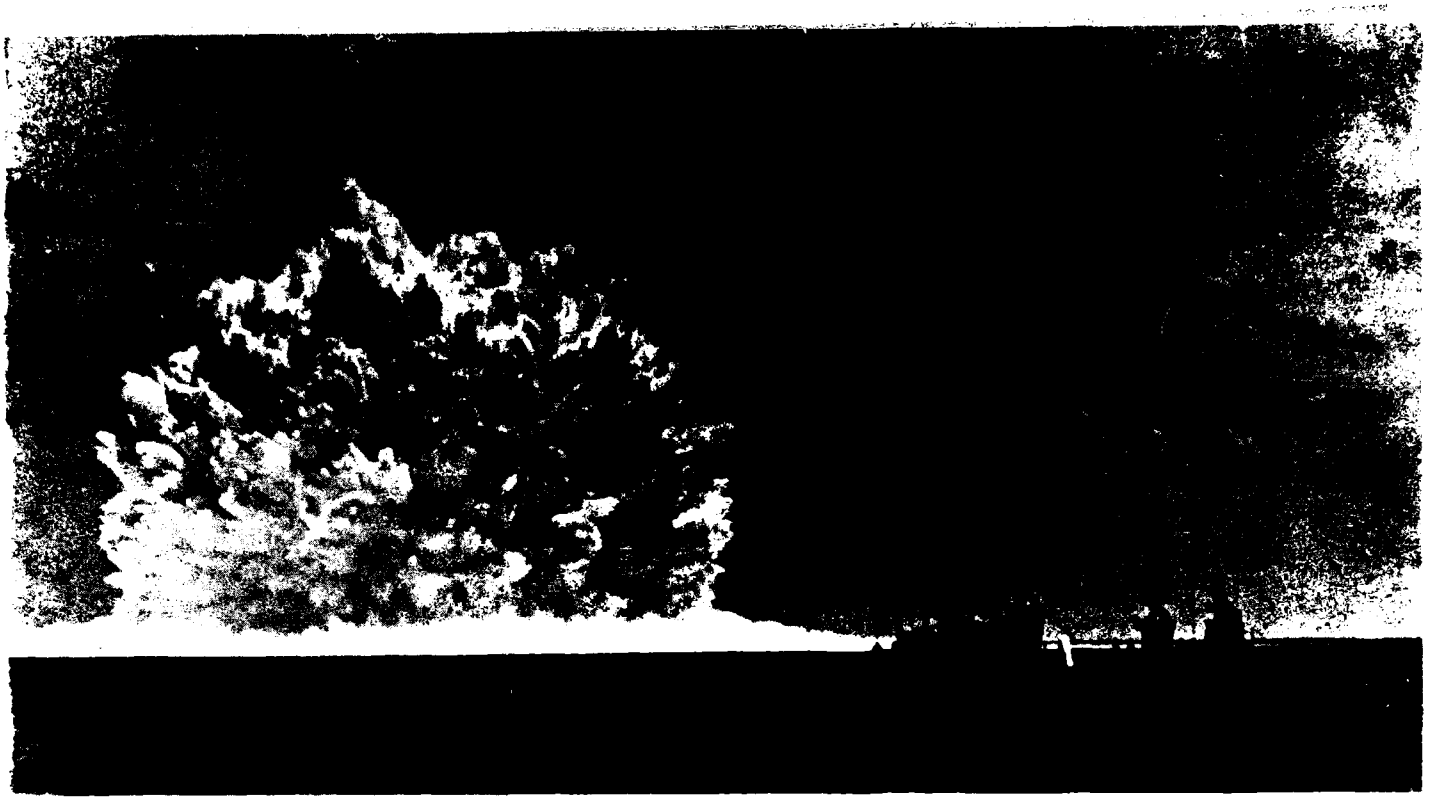
The Phase I study will proceed along the following lines: present and future (1990-2000) submarine ASW threats will be defined; concepts will be developed for operational employment of present and new weapon systems; capabilities of present and proposed weapon systems against the defined threats will be evaluated; operational impact on our ASW forces of new weapon systems will be determined; and conclusions will be drawn from study results and recommendations made.

In FY 78 the basic Advanced Light Weight Torpedo (ALWT) ASW threat was modified for use in the TACNUC Phase I study and is awaiting approval by the Naval Intelligence Support Center. Technical data on present weapons have been collected and provided to NWEF as working papers.

The threat used in the study was synthesized from available weapon studies, with the ALWT threat providing the major input. The current ASW weapon systems, both nuclear and non-nuclear, have been described, and the sensor effort which provides the basic localization data has been completed.

Due to restrictions on the extension of exploratory development funds, it appears that an effort will be made to complete the study by the end of Calendar Year 1978.

The members of the steering committee feel that the compression of the schedule



The first operational firing of a nuclear anti-submarine rocket.

may not allow time for a best effort, particularly since some small but important facets of the overall nuclear ASW problem are on a contractual basis, calling for completion at the end of FY 79. The shortened time would probably preclude these inputs to the in-house analysis effort.

A major problem area within nuclear-capable organizations is weapon security. This concern has gradually led to an apathetic attitude toward tactical nuclear weapons aboard ship, resulting in some decrease in readiness. Unfortunately, this comes at a time when the greatest threat to US naval forces at sea is highly effective Soviet Navy nuclear capability.

A major objective to any follow-up studies following Phase I would be the development of nuclear ASW systems that alleviate most or all of our present weapon security problems.

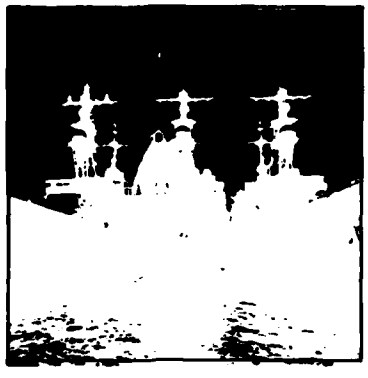
Naval warfare advisory group

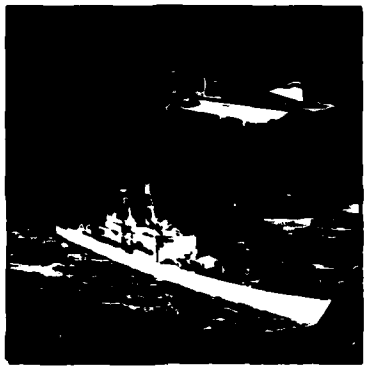
Established by the Director of Navy Laboratories, the Naval Warfare Advisory Group (NWAG) promotes a coordinated effort among the Navy Laboratories and Centers, the Chief of Naval Operations, and the Center for Naval Analysis in the general area of naval warfare.

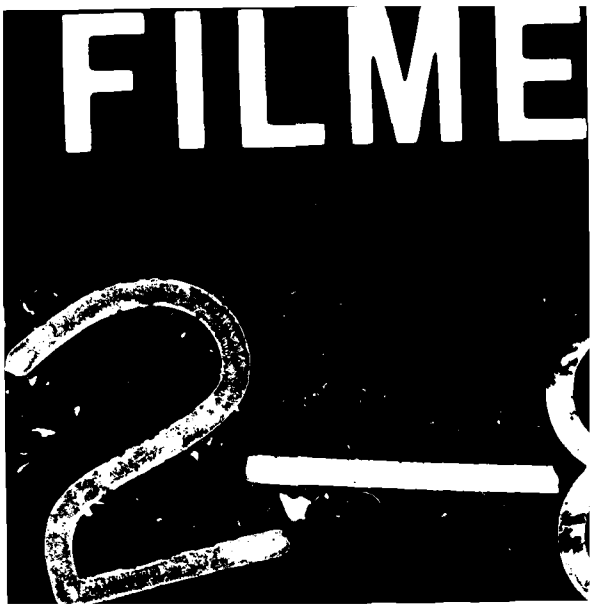
FRO provides senior scientific membership to NWAG and maintains continuous communication with NOSC personnel via many formal and informal conferences.

During FY 78 NWAG senior members participated in RIMPAC 78 (the sixth in a series of major multinational exercises), to observe Fleet problems, assist in analysis, and provide inputs to methodology for measures of effectiveness.

Other FY 78 accomplishments included planning the approach for tactical development and evaluation support to laboratories, reviewing Fleet needs and deficiencies, conducting laboratories' Fleet support assessment, and identifying gaps in the Centers' studies and analyses programs.






FILME